of the chalazal region of the seed was studied in some detail, and the attempt is made to correlate the structure with the functions of this region in conveying food to the young seed after the cutinization of its coats, and in providing for the necessary gaseous interchange with the seed.

The embryo-sac is developed, without division to tapetum or megaspores, from a hypodermal cell of the ovule. The antipodals are evanescent, and the multinucleate endosperm-sac grows to occupy the whole peripheral region of the campylotropous ovule, and is finally filled by the strongly curved embryo. The endosperm is a single layer of cells throughout, though much thicker in the micropylar cap of endosperm which covers the radicle in the mature seed. This part of the endosperm seems the more important, and evidently serves the part of a digesting and absorbing structure in transferring food material from the nucellus to the embryo during its later intraseminal development and the early stages of germination. This function is indicated by the position of the endosperm, by the nature of its cell contents, and by the fact that seeds from which the endosperm has been removed do not germinate.

This work of Miss GIBBS adds another series of perisperm-containing seeds to those in which JOHNSON[11] and LEWIS[12] have shown that the endosperm is not for the storage of food for the embryo, but serves to digest and pass on to the embryo, before and during germination, the starch stored in nucellar tissue.—DUNCAN S. JOHNSON.

The structure of Trigonocarpus.—SCOTT and MASLEN[13] have been investigating the structure of certain species of Trigonocarpus, a common seed-genus of the British Coal-measures. The species discussed are *T. Parkinsoni*, which name replaces the more familiar *T. olivaeforme*, and *T. Oliveri*, a new species. The general oval form of the winged body of the seed and its very prominent micropylar beak are the familiar features. The testa is distinctly cycadean in character, the outer fleshy and the stony layers being very evident, while there are traces of the inner fleshy layer. The micropylar beak is often as long as the body of the seed, and in some specimens twice as long, and is peculiar in bearing two broad wings, whose real nature is problematical. The nucellus and testa are free throughout, a feature, presumably an ancient one, belonging to certain paleozoic seeds. The vascular system of the seed is in general that described by OLIVER for Stephanospermum, namely, an outer system running in the outer fleshy layer, and an inner system traversing the nucellus. This nucellar system in Trigonocarpus is quite conspicuous, forming a "practically continuous sheath" in the lower part of the nucellus, and traceable through the whole length of the nucellus, almost to the base of the pollen chamber. The pollen chamber is rela-

[11] BOT. GAZETTE **34**:321–340. *pls. 9, 10.* 1902.

[12] BOT. GAZETTE **40**:79. 1905.

[13] SCOTT, D. H., and MASLEN, ARTHUR J., The structure of the paleozoic seeds *Trigonocarpus Parkinsoni* Brongniart and *Trigonocarpus Oliveri*, sp. nov. Part I. Annals of Botany **21**:89–134. *pls. 11–14.* 1907.

tively small and has not been found to contain pollen grains. The megaspore membrane is distinct, but structureless, and no traces of endosperm or archegonia were found.

The second part of the paper will be devoted to a discussion of the general bearing of the investigation and the probable affinities of the seed. It is to be regretted that in such a paper the citation of literature is not more specific. Reference merely to volume numbers puts needless work upon those who wish to consult the literature.—J. M. C.

Dorsiventrality in mosses.—NĚMEC has continued his study of dorsiventrality induced by light, finding additional species[14] in which this character can be altered. The tenacity with which dorsiventrality is retained under changed illumination differs widely. Thus in *Anomodon viticulosus* every flank in turn, as more strongly illuminated, may become the dorsal side. In Neckera and Homalia, on the contrary, only the dorsal and ventral sides could be made to exchange relations. Ageotropic species are usually strongly diaheliotropic (but may become positively clinoheliotropic), turning the dorsal side toward light. Geotropic species are hindered from acquiring a diaheliotropic position, especially if they must curve nearly to the horizontal. The species whose dorsiventrality is not reversible sometimes do not attain completely the diaheliotropic position if much bending is required. Such incomplete reactions are still more common among leafy Jungermanniaceae.

In a later paper on the same lines[15] NĚMEC deals especially with *Fissidens* spp., and *Dicranum scoparium*. In Fissidens the dorsiventrality (morphological as well as physiological) can be abrogated and recalled at will. The stems are also diaheliotropic and geotropic. In *Dicranum scoparium* the lateral curvature of the leaves is a heliotropic response which is induced very early and persists for a considerable time even in darkness, but finally disappears, returning again with one-sided illumination. The complicated interrelations of geotropism and heliotropic dorsiventrality are worked out in detail.—C. R. B.

Galvanotropism of roots.—A paper on this subject, published in September 1904 by Dr. AMOS PLOWMAN,[16] has come to our attention since writing the notice of the papers by SCHELLENBERG and GASSNER.[17] The methods used and the conclusions reached are anticipatory, in large measure, of those of GASSNER. PLOWMAN used carbon electrodes and states the strength of currents used in terms of current density, those mentioned lying mostly between 0.1 and 1.5 milli-

[14] NĚMEC, B., Die Induktion der Dorsiventralität bei einigen Moosen. II. Bull. Int. Acad. Sci. Boheme **11**: (1–7). 1906.

[15] NĚMEC, B., Die Symmetrieverhältnisse und Wachstumsrichtungen einiger Laubmoose. Jahrb. Wiss. **43**:501–579. *figs. 33.* 1906.

[16] PLOWMAN, A., Electrotropism of roots. Am. Jour. Sci. IV. **18**:228–236. *pls. 9, 10.* 1904. Also earlier reports *ibid.* **14**:131. 1902, and **15**: 94–104. 1903.

[17] BOT. GAZETTE **43**:218. 1907.